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Contents

THE PHYLOGENY OF THE ANGIOSPERMS, <i>Herbert F. Copeland</i>	209
STUDIES IN WESTERN VIOLETS—III, <i>Milo S. Baker</i>	218
DR. SETCHELL AND ALASKA WILLOWS, <i>Carleton R. Ball</i>	231
A PLEISTOCENE RECORD OF <i>PSEUDOTSUGA MACROCARPA</i> , <i>Herbert L. Mason</i> ...	233
A NEW SPECIES OF <i>LECIDEA</i> FROM BRAZIL, <i>Albert W. C. T. Herre</i>	235
ADDITIONS TO OUR KNOWLEDGE OF THE FLORA OF MOUNT BAKER, WASHINGTON, <i>W. C. Muenscher</i>	236
REVIEWS: <i>Fassett, A Manual of Aquatic Plants</i> (<i>Herbert L. Mason</i>); <i>Ammons, A Manual of the Liverworts of West Virginia</i> (<i>Annetta Carter</i>); <i>Jaeger, Desert Wild Flowers</i> (<i>David D. Keck</i>)	237
NOTES AND NEWS: <i>Southern Occurrences of Allium crenulatum and Meco- nella oregana</i> (<i>George B. and Ruth P. Rossbach</i>); <i>News</i>	240

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A WEST AMERICAN JOURNAL OF BOTANY

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THE PHYLOGENY OF THE ANGIOSPERMS

HERBERT F. COPELAND

The gist of this paper was presented at a symposium of the Western Society of Naturalists, honoring Dr. Douglas H. Campbell, at Monterey, California, December 21, 1939. The title is that of one of Dr. Campbell's papers (6). I owe it to Dr. Campbell to make it clear that some of the opinions stated are not his.

The concept of phylogeny is in modern biology intimately bound up with that of natural classification; and the natural classification of the flowering plants is, and has been for some three hundred years, one of the major problems of science. The history of work on this problem may be represented by a phylogenetic tree, which, by a figure of speech, may be called a phylogeny of phylogenies (text fig. 1, a)

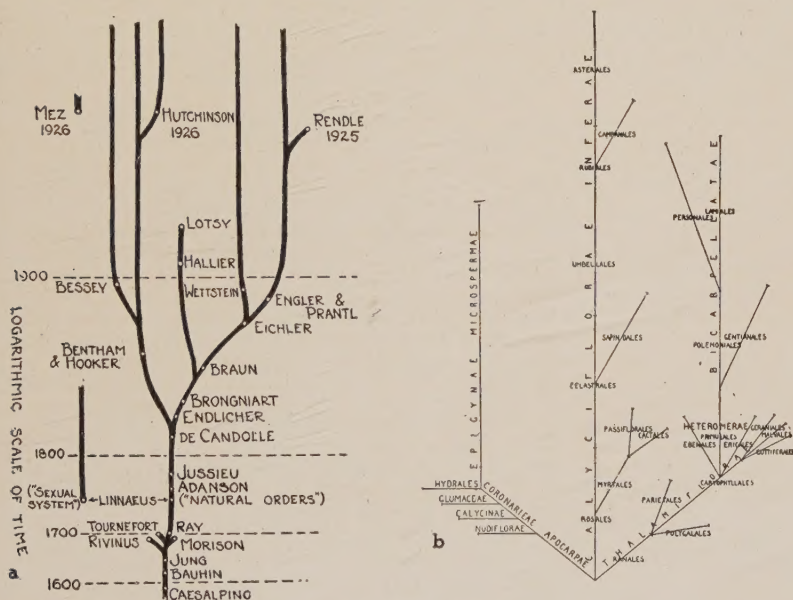


FIG. 1. Phylogenetic diagrams: a, "phylogeny of phylogenies"; b, phylogeny of the angiosperms according to Bessey, Bot. Gaz. 24: 177. 1897.

The earlier names in this history are now merely of historical interest. It may be worth while, as a matter of historical accuracy and justice, to justify the position of Linnaeus in the main line of development of the natural system. It is generally known that he appended to his *Genera Plantarum* (21) a list of fifty-eight natural orders, not described, but identified by lists of included genera. It is noteworthy that in this list he recognized

the distinction, discovered by Ray, between monocots and dicots; though he does not use the names of these groups. In effect, he did what we do in any modern manual: he prefixed an acknowledgedly artificial key to an attemptedly natural arrangement of the genera. It is not he, but the smaller men who followed him, who may be said to have delayed the development of the natural system by an uncritical acceptance of his artificial system. It is further to be noted that Adanson (1), to whom a place in the history of natural classification is generally conceded, set up a series of families exactly as many as the natural orders of Linnaeus, many of them being the same groups.

Botanists of the early nineteenth century referred to the "natural orders of Jussieu" as if to imply that Jussieu had founded natural orders, or even the natural system. More justly, we would attribute to Jussieu the popularization of the idea of natural orders. He made the recognition of natural orders a practical convenience by the establishment of a system of named higher groups to include them. The skeleton of his system is as follows (19):

- I. Acotyledones, i. e., seedless plants: Class I.
- II. Monocotyledones
 - Stamina hypogyna: Class II.
 - Stamina perigyna: Class III.
 - Stamina epigyna: Class IV.
- III. Dicotyledones
 - Apetalae
 - Stamina epigyna: Class V.
 - Stamina perigyna: Class VI.
 - Stamina hypogyna: Class VII.
 - Monopetalae
 - Stamina hypogyna: Class VIII.
 - Stamina perigyna: Class IX.
 - Stamina epigyna, antheris connatis: Class X.
 - Stamina epigyna, antheris liberis: Class XI.
 - Polypetalae
 - Stamina epigyna: Class XII.
 - Stamina hypogyna: Class XIII.
 - Stamina perigyna: Class XIV.
 - Diclincs irregulares: Class XV; orders Euphorbiae, Cucurbitaceae, Urticeae, Amentaceae, and Coniferae.

It was not arbitrarily, but according to precedent, that Jussieu treated the category of classes as of rather low rank, and that he designated the classes by number rather than by name. The varying sequence of the hypogynous, perigynous, and epigynous subdivisions was evidently intended to provide transitions linking together the series of main groups respectively of monocots, apetalae, monopetalae, and polypetalae. These groups as

main groups of angiosperms, and their subdivision primarily by hypogyny, perigyny, or epigyny, have to a considerable extent remained in use through the hundred and fifty years to the present time. The sequence in which these groups are arranged has, however, been changed repeatedly.

During most of the nineteenth century, the ideas of the de Candolles were dominant. The original Candollean arrangement need not be presented. The fundamental difference between gymnosperms and proper dicots having been pointed out by Robert Brown, the following modification of the Candollean system was put forward by Asa Gray (15):

Series I. Phaenogamous or flowering plants.

Class I. Dicotyledons.

Subclass I. Angiosperms.

Div. 1. Polypetalous.

Div. 2. Gamopetalous (Monopetalous).

Div. 3. Apetalous.

Subclass II. Gymnosperms.

Class II. Monocotyledons.

Series II. Cryptogamous or flowerless plants.

The sequence just quoted was followed by Bentham and Hooker (3) in what has turned out to be the ultimate elaboration of the Candollean system.

In the mean time the classification of angiosperms had undergone in Germany an independent development. This culminated in the system of Engler and Prantl (10), summarized as follows:

Seedless plants.

Gymnosperms.

Monocots.

Apetalae.

Choripetalae (i. e., Polypetalae).

Sympetalae (i. e., Monopetalae or Gamopetalae).

This system was explicitly an attempt to represent phylogeny. Engler was highly conscious of the prevalence of parallel evolution. He supposed that various groups of Apetalae and Choripetalae, as well as the whole group of monocots, had originated independently of one another from a hypothetical extinct group of gymnosperms; and that various groups of sympetalae had had an independent origin among the Choripetalae. The Apetalae, Choripetalae, and Sympetalae, then, are to be regarded not as natural groups but as evolutionary levels. The system was presented to the world in an extensive work, useful in the recognition and placing of all the genera, written in a modern language, profusely illustrated, and supported by the prestige of the German science of the time. It was generally accepted as the true system; most herbaria and most manuals follow it.

The status of the Englerian system as the accepted system has for half a century made it a prime object of attack. The principle of the representation of phylogeny is universally accepted; but whereas Engler used this principle to justify the resurrection of features of the system of Jussieu, those who have refused to follow him have tended to use it to justify features of the Candollean system. Three systems which exhibit this tendency are now to be discussed.

1. Bessey (4) put forward a system represented by the phylogenetic tree here reproduced (text fig. 1, b). He assumes that the whole group of angiosperms, and its two main subdivisions, monocots and dicots, are natural groups; that among dicots the Choripetalae, and particularly the order Ranales, are primitive and a natural group; but that Apetalae and Sympetalae are not natural groups, each including more than one line of descent from Choripetalae. He drops all three as taxonomic groups: he arranges the orders of dicots in two series, distinguished by hypogyny on the one hand as contrasted with perigyny or epigyny on the other. In effect, he makes a primary division by the character which Jussieu had used in making a secondary division. It is an obvious criticism, that perigyny and epigyny cannot be assumed to be the marks of a single evolutionary line: surely, these characters have appeared repeatedly, just as have apetalay and sympetalay. The Besseyan system has never commanded wide acceptance, but it must be regarded as a living system, having been followed in recent works by Clements and Clements (8), Pool (23), and Swingle (25).

2. Hallier (16), like Bessey, regarded Angiospermae, Monocotyledoneae, and Dicotyledoneae as natural groups, and Ranales as primitive; but his system does not resemble that of Bessey in detail. He supposed Sterculiaceae to be an important secondary center of variation derived from Ranales. He was followed by Lotsy (22) in a work which was never completed. He has had few other followers; he wasted his energies to an unseemly extent in railing against "*Engler und seine geistigen Kinder und Enkel*" (17).

3. Hutchinson (18), like Bessey and Hallier, postulates the naturalness of Angiospermae, Monocotyledoneae, and Dicotyledoneae, and the primitiveness of Ranales. The distinguishing feature of his system is the emphasis placed upon growth form, that is, on the woody as contrasted with the herbaceous character. Woodiness is assumed to be primitive, and the herbaceous dicots are for the most part arranged in a single derived line of descent. This arrangement is open to essentially the same criticism as that of Bessey, in that it assumes a certain evolutionary change to have taken place only once, when it may well have taken place many times. I do not know that this system has been followed in any manuals or herbaria; but it is a living

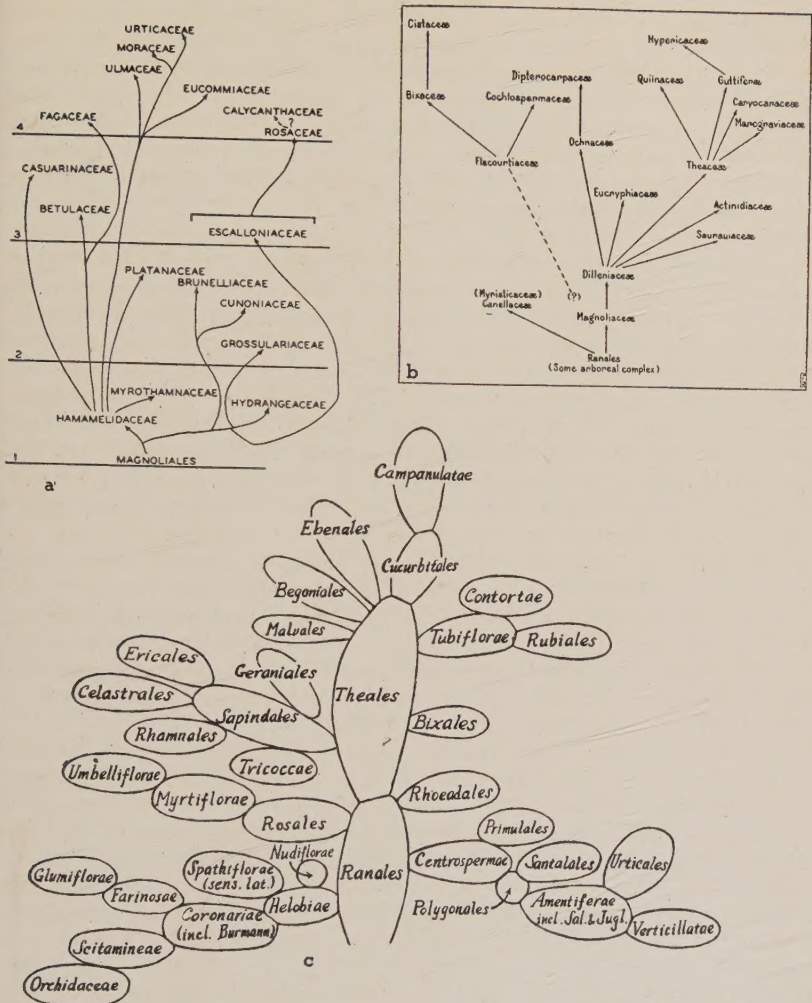


FIG. 2. Phylogenetic diagrams: a, phylogeny of Urticales and related groups according to Tippo; b, phylogeny of Theineae according to Vestal; c, the orders of angiosperms (as limited by various authorities) arranged according to Mez.

system in the sense that it demands consideration whenever the relationships of any family are under discussion.

The history just sketched is that of a persistent effort to divide the dicots into a small number of easily distinguishable natural groups. The effort has been a failure; one or more of the subdivisions established by each system have turned out to be products of parallel evolution. The characters used have been matters of gross morphology. The leaders of botany, the framers of systems, have not been unaware of the necessity of

considering all characters. They have used gross characters because these were known, being easily recognizable in dried specimens and recorded for the whole range of higher plants. When the Englerian system appeared, no phase of the anatomical, chemical, or physiological branches of botany afforded a body of data adequate for taxonomic application. More recently, several such bodies of data have accumulated to the extent that their significance can be estimated; four of these are now to be discussed.

1. The leader in the study of the vascular anatomy of the receptacle has been Eames (9), and the center of study has been Cornell. It has been found that in Magnoliaceae and Ranunculaceae the vascular supply of the floral parts is essentially that of vegetative leaves. Fusion or suppression of floral leaves is accompanied—or preceded or followed—by fusion or suppression in the vascular system: the cauline nature of the receptacle, and the foliar nature of the other parts of the flower, may become unrecognizable. It is evident from this body of data that the Ranales are primitive and that there has been much parallel evolution.

2. The main outline of the embryogeny of angiosperms was worked out by Hofmeister. Early comparative studies gave the impression that the group is quite uniform. When, therefore, Treub (28) discovered chalazogamy and other abnormalities in *Casuarina*, he concluded that this genus should be placed in a class by itself, distinct from both monocots and dicots. Again, when Campbell (5) discovered in *Peperomia* an embryo sac which does not at all conform to the normal type, he concluded that Piperaceae is an ancient group, of distinct origin from the angiosperms with normal embryo sacs. In short, the period when the embryogeny of angiosperms was supposed to be quite uniform was followed by one in which it was supposed to be so varied as to indicate multiple origin. Some forty more years have passed; Chicago and Vienna have been centers of embryological study, and Schnarf (24) has prepared a useful compendium of the results up to 1930. It is found that the type of embryo sac which includes eight nuclei derived from one which is produced by reduction division is indeed the normal type. It occurs in the overwhelming majority of the families; it extends to groups as far apart as Ranales, Campanulatae, and Glumiflorae. From the normal type there are parallel deviations which result, for example, in the same derived type in families as far apart as Liliaceae and Plumbaginaceae. In the order Myrtiflorae, most of the families exhibit the normal type; Onagraceae has a peculiar type of its own; Penaeaceae and the genus *Gunnera* have developed the same peculiarities as *Peperomia*. Characters of the embryo sac, then, decidedly make it probable that the angiosperms are a natural group. The normal type embryo sac is primitive, and deviations from it indicate derivation; but it sur-

vives in groups otherwise highly advanced. In the several other embryological characters, various features are marks of natural groups: thus a developing endosperm which consists of four cells in a row marks the order Ericales.

3. The comparative anatomy of woods has been studied notably at Harvard. There has been developed a doctrine of the evolution of vessels (11, 12, 13); of wood rays (20); and of wood parenchyma. The anatomy of wood is held not in itself to indicate natural groups, but only degree of evolution; it is used to test hypotheses that this group is derived from that, and yields as answer either "it is possible" or "it is impossible." The effect has been to demonstrate the parallel evolution of many lines of woody plants from a common source in or near Magnoliaceae. Herbaceous plants are interpreted as having originated repeatedly in primitively woody groups. Some of the detailed results may be presented. Tippe (27) finds it probable that Fagaceae and Betulaceae, Urticales, and *Casuarina* are closely related (text fig. 2, a) all being descended through Hamamelidaceae from Magnoliaceae. Juglandaceae and Aristolochiaceae, which fall near these families in the Englerian system, are found to have nothing to do with them. Vestal (29) has worked out the phylogeny (text fig. 2, b) of the group called Theineae in the Englerian system. He finds it a primitive group, connected directly with Magnoliaceae. The group which Hutchinson calls Bixales is not closely allied with it. This group Theineae or Theales or Guttiferales is of particular interest to me because I believe that both Ericales and Ebenales are derived from it—Ericales from Saurauiceae, Ebenales from Theaceae.

4. Tests for immunity—"serum diagnosis" or "immune reactions"—were first used for the identification for certain diseases and the bacteria which cause them. An animal, being rendered immune by vaccination to a certain organism, reacts in various ways, by agglutination, precipitation, or anaphylaxis, when exposed to protein of the species to which it is immune. It shows the same reactions in lower degree to proteins of related species. These immune reactions are characteristic of proteins in general, not only of those of bacteria. The study of reactions to plant proteins has been carried out chiefly by Mez, of Königsberg. The work has been reviewed in English by Chester (7). In 1926 it had been carried so far as to yield a complete phylogenetic tree. According to Chester, the pictorial representation published at that time is protected by copyright and cannot be reproduced; it is available in the work of Gortner (14). I have constructed from the original tree of families a tree of orders (text fig. 2, c). Some of the features of this tree are surprising: our authorities on wood anatomy would not allow the derivation of Amentiferae from Centrospermae, nor the inclusion of Juglandaceae in Amentiferae, nor the derivation of Bixales from Theales; and for my own part I am not content with the position

of Ericales. Theoretically the method is sound; I would conclude that it has not been adequately calibrated, that the degree to which conclusions can be drawn from the direct results has not been established. With an engine of the power of this one at our disposal, we are not wise in failing to use it when hypotheses as to relationship are to be tested. It is to be remarked that the use of the method is arduous and exacting, and quite outside of the range of technique in which botanical taxonomists are trained.

Apologies may here be offered, in that several other bodies of pertinent data—ecology, chemical characters aside from immune reactions, details of the structure of pollen grains, cytology and genetics—are not discussed. I am not aware that a science of systematic physiology has so much as been conceived; but physiological data are susceptible of systematic treatment. In the long run, these things will have to be taken into account.

Meanwhile, the four bodies of data discussed are conspicuously in agreement with each other and with the views of Bessey, Hallier, and Hutchinson, in making the Angiospermae a natural group and the Ranales primitive. These points should, I think, be accepted as positively established. If the Ranales are primitive, the angiosperms are not descended from the specialized group of Gnetales; nor from the cycadeoids (Wieland, 30), in which the carpels are reduced to stalks bearing solitary ovules; nor from the Caytoniales (Thomas, 26), in which the ovules are enclosed by the incurving ends of blades. No known plant, living or fossil, has the sort of carpel we require of the ancestors of the angiosperms, except only the genus *Cycas*; and in features other than the carpels, *Cycas* is not a good match for the hypothetical progenitor of the group. We are forced to postulate as such some extinct group of Cycadaceae. This is the conclusion reached long ago by Arber and Parkin (2).

From the Ranales the other angiosperms are derived, either directly or through secondary centers of variation, one of which appears to be Theales. They fall into many lines of descent. One such line, derived directly from Ranales, is the whole group of monocots; these are bound together not only by monocotyledony but by the whole range of their characters. Others are in general yet to be worked out. It is not probable that any of them will be found at the same time so extensive and so well marked as the monocots. Some or many of them may be definable by definite characters, as is the group of monocots. On the other hand, in view of the prevalence of parallel evolution, we should accustom ourselves to the probable necessity of accepting named taxonomic groups like the natural orders of Linnaeus, definable only by the list of groups included. Already it seems probable that the line of apetalous trees culminating in *Casuarina* should be accepted as constituting the order Amentiferae: but it is not easy to frame a list of characters by which it will include

Hamamelidaceae and Platanaceae while excluding Salicaceae and Juglandaceae.

When a group is assigned to its true place, it becomes inextricable: every character studied increases the certainty of the assignment. Many current hypotheses as to location show signs of becoming stronger; many families are letting it be known that their true place has been discovered. Not merely within the lifetime of contemporary taxonomists, but within a decade or two, there should be few families left to be placed by guess, as being too isolated by evolution, or too poorly known, for definite location.

Demonstration of the true phylogeny of all or of nearly all angiosperms will result automatically in revision of the taxonomic system; but it will not determine the names, nor the precise limits, nor in all cases the sequence, of the groups which are to be accepted. One is tempted to discuss features which may make one taxonomic arrangement preferable to another: but they are matters of taste or of mere accident. We may expect presently the establishment of a more sound and more stable taxonomic system than we have ever had, being a solution, as to the main outlines, of the long-standing problem of the classification of flowering plants.

Sacramento Junior College,
Sacramento, California,
February 3, 1940.

LITERATURE CITED

1. ADANSON, M. Familles des plantes. 2 vols. Paris, 1763.
2. ARBER, E. A. N., and J. PARKIN. On the origin of the angiosperms. Journ. Linn. Soc. Bot. 38: 29-80. 1907.
3. BENTHAM, G., and J. D. HOOKER. Genera plantarum. 3 vols. London, 1862-1883.
4. BESSEY, C. E. Phylogeny and taxonomy of the angiosperms. Bot. Gaz. 24: 145-178. 1897.
5. CAMPBELL, D. H. Die Entwicklung des Embryosackes von Peperomia pelucida Kunth. Ber. d. deutschen Bot. Ges. 17: 452-456. 1899.
6. ———. The phylogeny of the angiosperms. Bull. Torrey Bot. Club 55: 479-497. 1929.
7. CHESTER, K. S. A critique of plant serology. Quart. Rev. Biol. 17: 19-46; 165-190; 294-321. 1937.
8. CLEMENTS, F. E. and E. S. Flower families and ancestors. New York, 1928.
9. EAMES, A. J. The role of flower anatomy in the determination of angiosperm phylogeny. Proc. Congr. Pl. Sci. Ithaca 1: 423-427. 1929.
10. ENGLER, A., and K. PRANTL. Die Natürlichen Pflanzenfamilien. 20 vols. Leipzig, 1887-1909.
11. FROST, F. H. Specialization in secondary xylem of dicotyledons I. Origin of vessel. Bot. Gaz. 89: 67-94. 1930.
12. ———. II. Evolution of end wall of vessel segment. Bot. Gaz. 90: 198-212. 1930.
13. ———. III. Specialization of lateral wall of vessel segment. Bot. Gaz. 91: 88-96. 1931.
14. GORTNER, R. A. Outlines of biochemistry. . . . New York, 1929.
15. GRAY, A. Gray's botanical text book. vol I. Structural botany. . . . sixth edition. New York, 1907.

16. HALLIER, H. Vorläufiger Entwurf des natürlichen (phylogenetischen) Systems der Blütenpflanzen. Bull. Herb. Boissier ser. 2, vol. 3: 306-317. 1903.
17. ———. Über die Lennoeen. . . . Bot. Centralbl. Beih. 40²: 1-19. 1923.
18. HUTCHINSON, J. The families of flowering plants. I. Dicotyledons. London, 1926.
19. DE JUSSEU, A. L. Genera plantarum secundum ordines naturales disposita. Paris, 1789.
20. KRIEBS, D. A. Salient lines of structural specialization in the wood rays of dicotyledons. Bot. Gaz. 96: 547-557. 1935.
21. LINNAEUS, C. Genera plantarum. . . . sixth edition. Stockholm, 1764.
22. LOTSY, J. P. Vorträge über botanische Stammesgeschichte. vol. 3¹. Jena, 1911.
23. POOL, R. J. Flowers and flowering plants. . . . New York, 1929.
24. SCHNARF, K. Vergleichende Embryologie der Angiospermen. Berlin, 1931.
25. SWINGLE, D. B. A textbook of systematic botany. New York, 1934.
26. THOMAS, H. H. The Caytoniales, a new group of angiospermous plants from the Jurassic rocks of Yorkshire. Phil. Trans. Roy. Soc. B 213: 299-364. 1925.
27. TIPPO, O. Comparative anatomy of the Moraceae and their presumed allies. Bot. Gaz. 100: 1-99. 1938.
28. TREUB, M. Sur les Casuarinees et leur place dans la système naturel. Ann. Jard. Bot. Buitenzorg 10: 145-231. 1891.
29. VESTAL, P. A. The significance of comparative anatomy in establishing the relationship of the Hypericaceae to the Guttiferae and their allies. Philippine Journ. Sci. 64: 199-256. 1938.
30. WIELAND, G. R. American fossil cycads. Carnegie Inst. Publ. 34. 1906.

STUDIES IN WESTERN VIOLETS—III

MILO S. BAKER

The investigation of certain problems concerning the violets of the Pacific Northwest called for field study; to this end during the month of June, 1938 and 1939, trips were taken through western Oregon, Washington and British Columbia to visit the localities in which the problems centered.

VIOLA OCELLATA Torr. & Gray. Through correspondence with Mrs. Cora Ollivant I had learned that *Viola ocellata* had been collected in the vicinity of Looking Glass Post Office, a few miles southwest of Roseburg, Oregon, on the ranch of Thomas Ollivant. This is a matter of interest to students of *Viola* since this species was not known with certainty to grow in Oregon, its most northern known limits being northern Humboldt County and central Shasta County in California. In Gray's "Synoptical Flora," published in 1897, it was stated that this violet had been collected in the Cow Creek Mountains of Oregon, but diligent inquiry on my part had until now failed to confirm this report. On a hillside at a distance of less than a mile from the ranch house there was a colony of this violet. Although not covering a wide area here, the colony was flourishing and the individuals appeared very similar to typical California plants. Both transplants and herba-

rium specimens (June 19, 1938, *Baker 9033*) were secured. The Ollivants assured me that they had collected this species also on Sugar Pine Mountain about five miles west by air line from their ranch. They had also noted its occurrence on another mountain near there. Thus it appears that *Viola ocellata* is well established in that region. This occurrence suggests that sometime in the remote past this violet had a continuous distribution southward through Oregon and northern California to its present range in Shasta and Humboldt counties but that, for some reason, presumably environmental, it has now disappeared from a strip several hundred miles wide in southern Oregon and northern California.

VIOLA LANCEOLATA L. Several years ago, Dr. George Neville Jones collected a very diminutive white marsh violet near Parkland, Washington (*Jones 8803*). A note was published by him in *Madroño* (4: 35. 1933) referring it to *V. lanceolata* L., a species known hitherto only in the eastern and central United States. My first thought was that he must be mistaken as to its identity. However, after examining Jones' material, I was convinced of the correctness of the identification. A search of the Parkland region proved unavailing. Dr. Jones, however, had collected another specimen of larger stature near Sea View, Washington (*Jones 2115*). The next day I went to the mouth of the Columbia River in search of *Viola lanceolata* along the marshes back of the town of Sea View. Here in a pasture about one mile north of town I found thousands of plants in good flower. The owner of the pasture came along at noontime and found a strange man digging up his land! However, after explanations he was sympathetic and bade me take all of this worthless weed that I wanted. It appears that *Viola lanceolata* is a pest in the cranberry bogs of this region and yet only one botanist was aware of its existence on the Pacific Coast. The species occurs in at least three spots near Long Beach and Sea View, Pacific County, Washington (June 25, 1938, *Baker 9055*), and I have no doubt that it can be re-located in the region about Tacoma and Parkland if searched for at the proper season. Indeed, Dr. Jones wrote me that he had collected it at several stations east and south of Tacoma.

A trustworthy explanation of this strange quirk in the distribution of *Viola lanceolata* is not yet forthcoming. To the eastward the species is unknown except in the region of the Great Lakes and farther east and south. Since it is a low altitude marsh plant it could not have migrated across the Rocky Mountains; yet the western plant is typical in all respects except in the small size of its seeds. In the absence of any verified explanation I shall venture a guess as to the origin of these plants, although, frankly, I have little evidence to support this speculation. It is known that *Viola lanceolata* grows in Venezuela. It is also known that

we have along our coast line a number of coastal species of South America. At the present writing, I have in mind *Fragaria chilensis* L., *Aster chilensis* Nees, *Madia sativa* Molina, *Lupinus densiflorus* Benth., all of which are fairly common along the Sonoma County, California, coastline. One explanation of the presence of these Chilean species along our own coast is that the seeds were brought here by migratory water fowl. It is common knowledge that thousands of individuals of water fowl including many different species, annually fly northward along our coast, and it is reasonable to suppose that small seeds, particularly of marsh plants, could be easily carried in the mud adhering to the feet of these migratory birds. If the mud or clay were sufficiently adhesive, it seems to me entirely credible that such seeds could be carried even from South America and deposited in the marshes as far north as the Columbia River and Tacoma.

Viola superba sp. nov. Radices in plantis maturis, adventitiae; herba glabra; caules erecti adscendentes, 25 mm. longi; caulium et rhizomatis internodia longitudine variabiles, 1–9.5 cm. longa; foliorum lamina conspicue venata rotunda ovato-cordata, 3.5–4.8 cm. lata, 3–5.2 cm. longa, regulariter serrato-crenata, serrae utrimque 12 ad 14, clare apiculata, sulco in foliis maturis circa 13 mm. alto; foliorum maturorum petioli crassi, .5–22 cm. longi; pedunculi crassi, 5–16.5 cm. longi; bracteolae ovatae lanceolatae adpressae, 2–3 mm. longae, supra medium pedunculi insertae; sepalum inferiorum ovatum, alteri elliptici obtusi scarisomarginati, 5–6 mm. longi; corolla purpurea ei *V. Langsdorffii* subaequalis; flori sicci 2.5 cm. diametro; petala superiora laminis suborbicularibus, lateralia leviter barbata, inferiora nuda, apice paullo retuso, 1.4 cm. lata, 2 cm. longa, calcare incluso; calcar conicum eburneum, 2 mm. diametro, 2 mm. longum; stylus crassus; foramen circa 5 mm. diametro; capsulae oblongo-ellipticae, 12 mm. longae; semina atro-fulva, 1.5 mm. lata, 2.3 mm. longa, pondere 2.3 mg., caruncula .57 longa seminum haud excedente.

Roots adventitious in mature plants as in *Viola simulata* and *V. Langsdorffii* but fewer, larger and more woody; whole plant entirely glabrous; stems erect or ascending, 2–25 cm. long; internodes variable apparently according to season, 1–9.5 cm. long; root-stocks or buried stems of former years with the same variable length of internodes; leaves conspicuously veined, rounded, ovate-cordate, distinctly apiculate, sulcus deep, averaging 13 mm. in mature leaves, evenly serrate-crenate, 12 to 14 serrations on each side of leaf, width and length approximately equal, 3.5–4.8 cm. wide, 3–5.2 cm. long; petioles of mature leaves stout, 5–22 cm. long; stipules ovate to lanceolate, entire, becoming scarious, 7–10 mm. long; peduncles stout, 5–16.5 cm. long; bractlets slightly above the middle of peduncle, ovate to lanceolate, appressed, 2–3 mm. long; lower sepal ovate, others elliptical, obtuse, scarious



PLATE 20. *VIOLA SUPERBA* BAKER. Photograph of type $\times 37$ (University of California Herbarium, Berkeley, no. 611206).

margined, 5–6 mm. long; corolla purple, as large as in *V. Langsdorffii*, dried flowers measuring 2.5 cm. in diameter; all petals rounded, the limb in upper petals as wide as long, the lower petal naked, slightly retuse at tip, 1.4 cm. wide at tip, 2 cm. long, including the cream colored conical spur, ca. 2 mm. in diameter, 2 mm. long; lateral petals lightly bearded; anterior appendages of stamens reddish tan, closely fitting the massive style, foramen unusually large, approximately .5 mm. in all diameters; capsules oblong-elliptical, up to 12 mm. long; seeds dark tan with a darker line along the raphe, 1.5 mm. wide, 2.3 mm. long, average weight ca. 2.3 mg., caruncle one-fourth length of seed, scarcely extending beyond seed point.

Type. Near Brookings, Josephine County, southern Oregon, June 29, 1938, M. S. Baker 9060, University of California Herbarium no. 611206.

In the spring of 1938 Dr. Doris Gillespie of Humboldt State Teachers College, Arcata, California, sent me specimens of a violet collected near Brookings, Josephine County, Oregon. I re-collected this violet in a peat bog just north of the town of Brookings. The highway had been cut through the marsh and there were a few of these violets growing on each side of the road. The individuals were very limited in number and I was unable to discover any plants other than those in this small bog.

This violet is closely related both to *Viola simulata* Baker and *V. Langsdorffii* Fischer. The habitat of all three species appears to be much the same, moist places near the ocean; they also agree in being entirely glabrous, devoid of stolons and more or less caulescent. The leaves of the three species closely resemble each other and each species has large purplish flowers. However, the pistils are quite different (pl. 22) and the extent of the caulescence varies greatly; there are also differences in stipules and rootstocks, in the form of the spurs, and in seed characters.

Specifically *Viola superba* can be distinguished from *V. Langsdorffii* by a widely different stigma, by more apiculate leaves with a deeper sulcus, and by stouter and fewer roots. It differs from *V. simulata* in possessing a more massive pistil with a stigma of different shape (Madroño 3: 239, pl. 11), much longer, erect or ascending stems, much larger stipules, larger flowers and stouter, fewer roots.

Except in the characters of the stigma, *Viola superba* seems closer to *V. Langsdorffii* than to *V. simulata*; it possesses erect or ascending stems as does the Langsdorff violet, its stipules are identical, and its flowers are fully as large and as beautiful. Unquestionably these two species have the largest purple flowers in North America and, in my opinion, also the most beautiful.

Although *Viola superba* has never been collected elsewhere, it is probable that it hails from the north and that the Brookings location is its most southerly limit. It is probably a relict, since

a plant with such striking flower could scarcely be overlooked if abundant anywhere. Farther north the species may exist but, since it could easily be confused with *V. Langsdorffii*, may have escaped collection. If this is true we may expect a collection sooner or later.

VIOLA BELLIDIFOLIA Greene subsp. **typica** nom. nov. *V. bellidifolia* Greene, Pittonia 4: 292. 1901.

In Madroño (3: 1. 1936) I expressed the opinion that later investigations might show *Viola bellidifolia* to be only a subspecies of *V. adunca*. Since that date I have obtained preserved flowers of *V. bellidifolia* from Poudre Lake, Colorado, and I find the characters of the pistil quite different from those of *V. adunca*. In the latter, the stigmatic tube and foramen are much smaller in diameter than the head, while in *V. bellidifolia* the stigmatic tube and foramen are scarcely smaller in diameter than the head itself. Also, in *V. bellidifolia* the direction of the beak has a fixed angle with the style, while in *V. adunca* this angle varies widely in different forms. These pistil differences of the two plants added to the differences in leaf outline fully justify *V. bellidifolia* as a distinct species.

VIOLA BELLIDIFOLIA Greene subsp. **valida** subsp. nov. A subsp. *typica* differt, foliis maturis maioribus elongatis, pedunculis elongatis.

Plants in the flowering stage tufted, 3-6 cm. high from a branched rootstock, springing from a slender but deep-seated yellowish tap root; type glabrous throughout but plants at other localities somewhat pubescent; early leaves mainly short-ovate, occasionally nearly round, or even wider than long, truncate to sub-cordate at base, obscurely serrate, obtuse at apex, 9-20 mm. long on petioles 1.5-4 cm. long; stipules inconspicuous, linear, faintly toothed, 2-3 mm. long; stems extremely short; mature leaves greatly enlarged and elongated, truncate at base or even slightly cuneate, obscurely serrate, 2.0-4.3 cm. long, 1.4-2.5 cm. wide, some being twice as long as wide, on petioles 2.5-8 cm. long; stipules scarcely longer than in early stage; stems in mature plants elongated occasionally to 8 or 9 cm.; flowers large for so small a plant, pale to dark lavender, somewhat exceeding the leaves, ca. 18-20 mm. in diameter; sepals lanceolate, acute, 5 mm. long (including auricle 1 mm. long), 1.5 mm. wide at base; upper petals obovate, 9 mm. long, 8 mm. wide, lateral petals narrower, 10 mm. long, 6 mm. wide, spur petal broad, obovate, 10 mm. wide at distal end, 10 mm. long, narrowed to a cylindric spur 8 mm. long and deeply notched at distal end; style exerted 0.6 mm. from stamen sheath, form of head and beak as in *V. bellidifolia* subsp. *typica*, beards on head of style very short with a wide base (pl. 22); seeds brown, 1.7 mm. long, 1.2 mm. wide, average weight 0.8 mg., caruncle as in *V. adunca* Smith.

Types. Brighton, Salt Lake County, Utah, July 18, 1936, *M. S. Baker* 8519 (in fruit), University of California Herbarium no. 624296; June 13, 1939, *M. S. Baker* 9367 (in flower), University of California Herbarium no. 624295.

This subspecies differs from the subsp. *typica* in its mature leaves which are not only greatly enlarged in all diameters and on much elongated peduncles, but have a changed outline due to a much greater increase in the length than in the width of the blades. In the flowering stage subsp. *valida* might easily pass for subsp. *typica* although the early leaves are somewhat more elongated, while the late seasonal stage might pass for a glabrous or glabrate form of *V. adunca*.

VIOLA UNCINULATA Greene, Leaflets 2: 97. 1910. This species, closely related to *V. bellidifolia*, was described by Greene from material collected in Crater Lake National Park by Mr. Elmer Applegate. Like *V. bellidifolia*, the plant is entirely glabrous and the leaf, though larger, is identical in form. The beak and the stigmatic foramen are very different (pl. 22). Moreover, *V. uncinulata* grows in a lower life zone than does *V. bellidifolia* and is confined to a limited area in central and southern Oregon. For these reasons, I regard *V. uncinulata* as a valid species belonging to *cenospecies V. adunca* Smith.

VIOLA SEMPERVIRENS Greene subsp. *typica* nom. nov. *V. sempervirens* Greene, Pittonia 4: 8. 1899.

VIOLA SEMPERVIRENS Greene subsp. *orbiculoides* subsp. nov. A subsp. *typica* differt, herba nana, ramis brevibus adscendentibus non radicantibus.

Type. In forest above the foot of Nisqually Glacier, Mount Rainier, Washington, elevation 4500 feet, July, 1924, *M. S. Baker* 736, University of California Herbarium no. 624808.

Other collections. Mount Angeles, Clallam County, Washington, September, 1924, *Baker* 865; Mount Arrowsmith, Vancouver Island, British Columbia, August 28, 1938, *Baker* 926.

This subspecies differs from subsp. *typica* in being a dwarf having its few short stems ascending instead of prostrate and rooting. It may be distinguished from *Viola orbiculata* Geyer, which it resembles, by the character of its leaves; those of the latter being larger, thinner and more nearly circular. The leaves of *V. sempervirens* subsp. *orbiculoides* are much thicker and are similar to those of subsp. *typica*.

During the summer of 1924 I found on Mount Rainier at higher elevations ranging from 3000 to 7000 feet, a violet which seemed in all characters to represent *Viola orbiculata* Geyer. It was similar to *V. sempervirens* Greene in leaves, flowers, fruits and seeds but differed in having short, erect or ascending stems while *V. sempervirens* has prostrate, rooting stems which branch freely and may extend to considerable distances in all directions. At



PLATE 21. *VIOLA BELLIDIFOLIA* SUBSP. *VALIDA* BAKER. FIG. 1. Early seasonal stage. FIG. 2. Late seasonal stage.

lower elevations I found everywhere on Mount Rainier (Longmire Springs, August 7, 1924, *Baker 776*), Mount Angeles and Mount Arrowsmith an abundance of *V. sempervirens*. Above the foot of Nisqually Glacier, Mount Rainier, at an elevation of approximately 4500 feet, I secured a single plant (*Baker 736*) of this dwarf form which, transplanted to my garden near Kenwood, Sonoma County, California, in the course of several years produced a mat of many interlacing stems each of which bore numerous adventitious roots (*Baker, 4151, 5547*). In other words, it developed into a colony of plants which could not be distinguished from *V. sempervirens*. Therefore, I was convinced that *V. orbiculata* differed only varietally or subspecifically from *V. sempervirens* and that the short, non-rooting stems resulted from the short growing season of higher altitudes. However, in the summer of 1939 I discovered in a forest a few miles north of Sandpoint, Idaho, at an elevation of only 2000 feet, an abundance of plants of *V. orbiculata* with short non-rooting stems even though the growing period was sufficiently extended to allow them to produce rooting stems (June 20, 1939, *Baker 9422*). It thus appears that these two similar non-rooting forms, one from the upper altitudes of the coastal mountains of Oregon, Washington and British Columbia and the other at varying altitudes in eastern Oregon, Washington, Montana, and inland British Columbia, have a different origin and represent different species, though morphologically they are difficult to distinguish.

Viola McCabeiana sp. nov. Herba acaulescens, rhizoma elongatum, tenue; lamina foliorum primorum saepe purpureo-tincta, rotundo-cordata, apice haud acuta, 1.5–2.7 cm. lata, 1.3–2.5 cm. longa; lamina foliorum tardiorum conspicue elongata serrata, apice acuta; pedunculi crassi, 7–19 cm. longi, supra medium bracteolis glanduloso-dentatis instructi; sepala oblongo-lanceolata obtusa integra, marginibus scariosis, apice conspicue calloso; auriculæ haud 1 mm. longae; corolla 15–25 mm. diametro, purpureo-caesia medio pallidiora; petalum inferiorum barbatum spatulatum emarginatum, 7 mm. latum, 16 mm. longum, calcare incluso; calcar obtusum flavum, 3 mm. latum, 2.5 mm. longum; petala lateralía anguste obovata barbata, petalum superiorum anguste obovatum, circa 6 mm. latum, 13 mm. longum; stylus clavato-capitellatus, fere 3 mm. longus, tuba stigmatosa extrorsa deorsum extendente; foramen ellipticum, .2 mm. altum, .3 mm. latum; semina fusca minute punctata, 1.2 mm. lata, 2.2 mm. longa, caruncula seminum leviter excedente inclusa.

Acaulescent; rootstock elongated, slender, much as in *Viola palustris* but not originating from stolons; early leaf blades small, round-cordate, regularly crenate, scarcely pointed at apex, often purple tinted, 1.5–2.7 cm. wide, 1.3–2.5 cm. long; later leaves conspicuously elongated with a sharpened apex and serration; stipules during early spring conspicuous, protecting the buds,

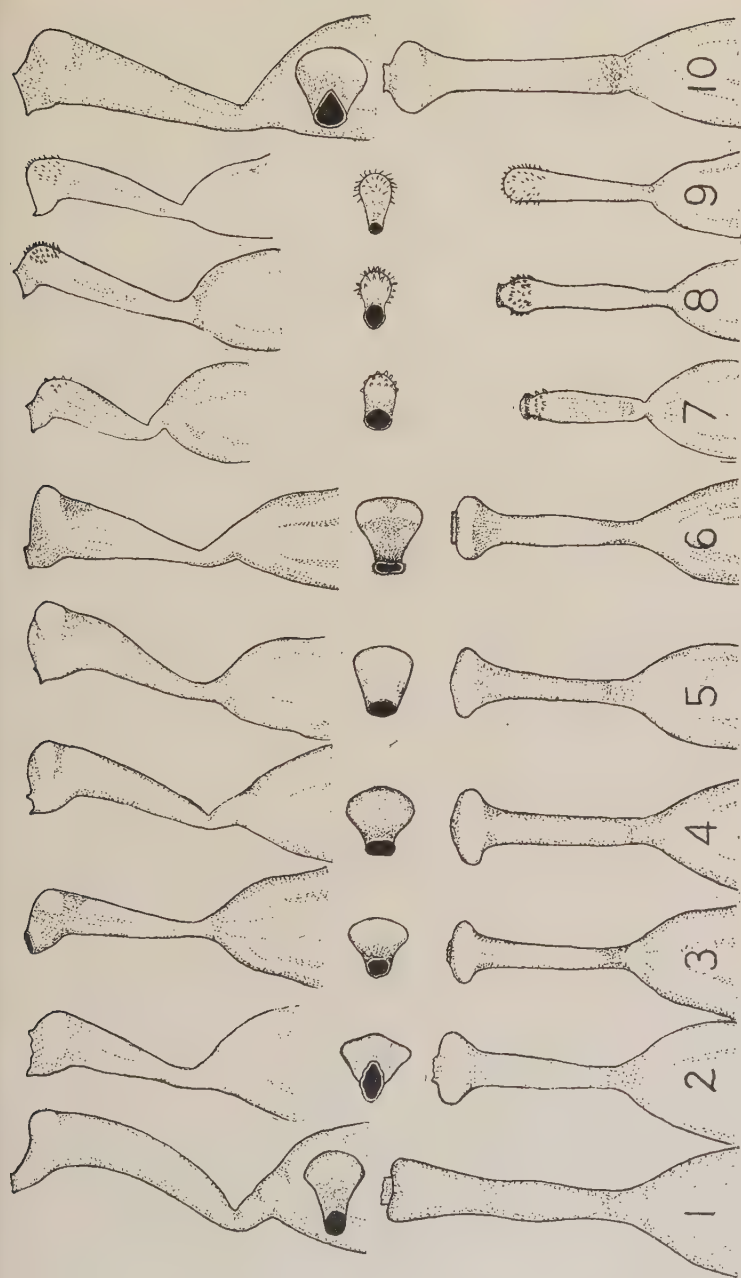


PLATE 22. PISTILS OF VIOLA. Side, front and dorsal views: 1, *V. Langsdorffii*; 2, *Clauseniana*; 3, *V. cognata*; 4, *V. arizonica*; 5, *V. McCabeana*; 6, *V. nephrophylla*; 7, *V. belidifolia* subsp. *typica*; 8, *V. belidifolia* subsp. *valida*; 9, *V. uncinulata*; 10, *V. superba* (all $\times 10$).

later becoming scarious and disappearing, ovate to oblong-lanceolate, irregularly toothed, 6–8 mm. long; peduncles stout, 7–19 cm. long with linear-lanceolate, glandular toothed bractlets mostly above the middle, 2–4 mm. long; sepals oblong-lanceolate, entire, scarious margined, obtuse, the callous tip conspicuous; auricles small, scarcely 1 mm. long; corolla variable in size, 15–25 mm. in diameter, purplish-lavender with lighter center; lower petal bearded, spatulate, emarginate at end, 7 mm. wide, 16 mm. long, including the blunt, yellowish spur, 3 mm. wide, 2.5 mm. long; lateral and upper petals narrowly obovate, the former bearded, *ca.* 6 mm. wide, 13 mm. long; stamens with tan-colored anterior appendages closely fitted around style; two lower stamens having a posterior appendage projecting backwards and downwards 2 mm. into the spur; style nearly 3 mm. long, ending in a club shaped head; stigmatic tube short, pointing downward and outward, foramen elliptical, .2 mm. high, .3 mm. wide; seeds brown, minutely speckled, 1.2 mm. wide, 2.2 mm. long, including the caruncle which projects *ca.* .2 mm. beyond point of seed.

Types. Southeast corner of Columbia Lake, Kootenay District, British Columbia, May 21, 1938, *T. T. McCabe 6149*, University of California Herbarium no. 612591, May 28, 1938, *T. T. McCabe 6363*, University of California Herbarium no. 633210; cotype, Canal Flats, Columbia Lake, June, 1939, *M. S. Baker 9444*, Herbarium of M. S. Baker.

This violet came first to my attention from a collection made, July 9, 1933, by Mr. Thomas T. McCabe at Indianpoint Lake, Caribou District, British Columbia (303). In 1934 he collected the same species at two other points, both near Indianpoint Lake (1115, 1226). This region lies along the western slopes of the Canadian Rockies about three hundred fifty miles by air line north of the United States border. In the summer of 1938 Mr. McCabe collected the same violet south of Kinbasket Lake, British Columbia (6263), also at Columbia Lake, Kootenay District, only eighty miles by air line from the boundary of Montana (6149, 6363). Columbia Lake marks the beginning of the Columbia River which flows nearly north at this point.

During June, 1939, I visited the spot at Columbia Lake where Mr. McCabe made his collections. Near the home of Mr. Charles Edwards there is a woodland bog quite above the lake. In this bog Mr. McCabe made his two collections and here my collection was made (*M. S. Baker 9444*). The violets were growing out in the bog and were difficult to collect. My recollection is that peat moss was growing there. At any rate, the grassy surface shook at every step. On all sides there is heavy timber and brush, and little direct sunlight reaches the surface; hence the petioles and peduncles of this violet are unusually long, one leaf extending 30 centimeters, and a young fruit 20 centimeters, above the surface (*M. S. Baker 9444*). However, on the ranch of Mr. Prust across the lake on the west side there is a colony of the same species in

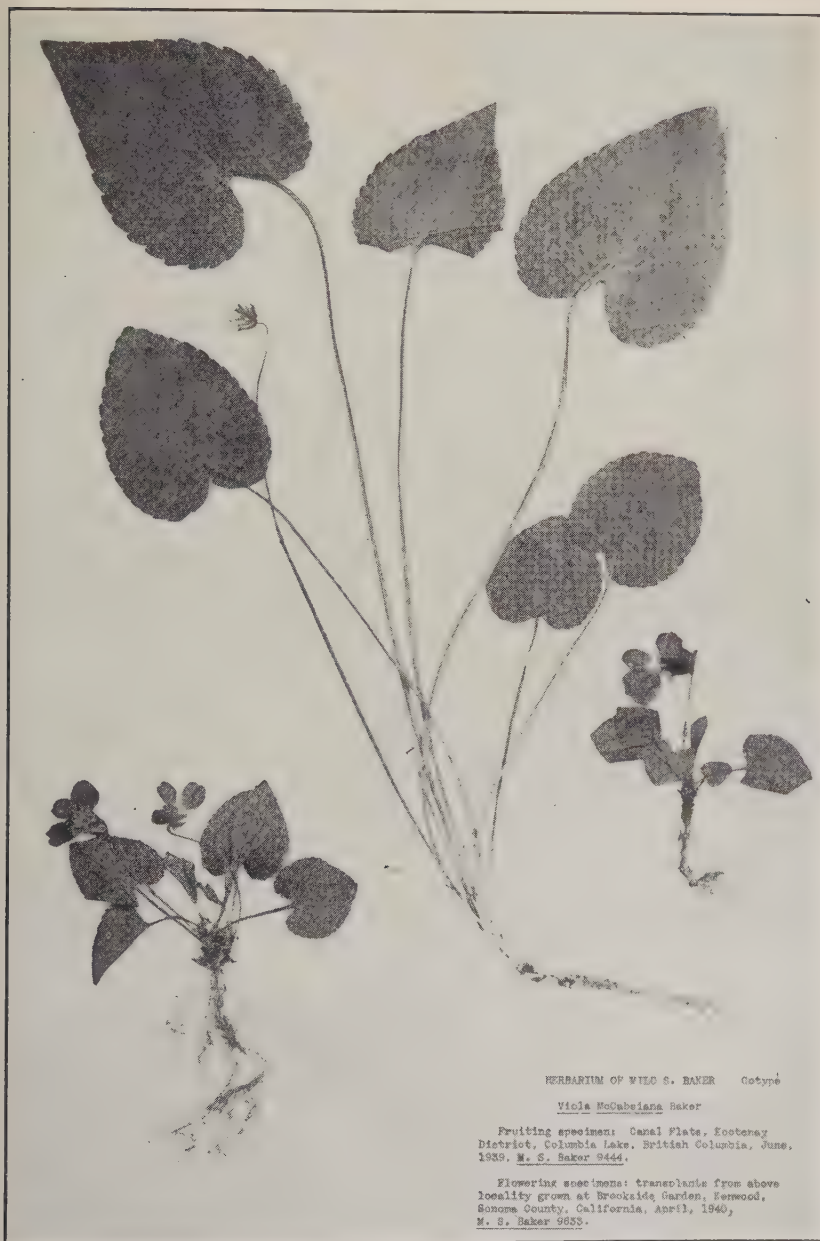


PLATE 23. *VIOLA MCCABELLANA* BAKER. Photograph of cotype $\times 4$ (M. S. Baker Herbarium, Kenwood, California).

a wet, grassy spot. This is an easterly and southerly exposure only thinly wooded and, due no doubt to an abundance of light, the height of leaves and flowers is much less. In this locality all petioles and under surfaces of leaves are conspicuously purple-tinted. I have noted the same tinting in the early leaves of *Viola cognata* Greene in Estes Park, Colorado.

Viola McCabeiana is most closely related to *V. prionosepala* Greene which was named in 1902 from a collection of the Canadian Survey (Chelsea, Quebec, *J. M. Macoun, 18972*). In appearance *V. prionosepala* and *V. McCabeiana* are very similar, both having long slender rootstocks, greatly elongated and sharply pointed later leaves and the spur petal distinctly bearded with unusually long hairs. They differ in the sepals, the pubescence and purple tinting of the leaves. In *V. prionosepala* the margins of the sepals are regularly and closely serrulate, a character entirely lacking in *V. McCabeiana*. In *V. prionosepala* the upper leaf surface is supplied with short appressed hairs, much as in *V. blanda* Willd. In *V. McCabeiana* at both stations about Columbia Lake the leaves are practically glabrous, although a diligent search with a good lens may uncover a few short hairs of the same character as in *V. prionosepala*. McCabe's specimens from Indianpoint Lake show a slight amount of pubescence on the upper leaf surface. The five sheets of *V. prionosepala* examined showed no trace of purple tinting on the lower leaf surface. The configuration of the stigma of *V. prionosepala* is unknown and must be until fresh or properly preserved flowers are obtainable.

Both of these species are unique in the group of Boreali-Americanae in possessing very slender, often greatly elongated rootstocks; all other members of this group have short and thickened rootstocks. However *Viola arizonica* Greene and *V. Clauseniana* Baker are two partial exceptions, each of these species showing a tendency towards slenderness of rootstocks. Both have two other characters in common with *V. McCabeiana* and *V. prionosepala*: the foliage is slightly pubescent and the later leaf-blades acute and elongate. *Viola arizonica* also grows in the same life zone as does *V. McCabeiana*. I have collected it in Pine Valley and near Navajo Lake in southern Utah, where it occupies the upper Transition zone. Moreover its style and stigma are of the same type, though not so massive, as is found in *V. McCabeiana* (pl. 22). These resemblances seem to indicate a genetic relationship and possibly a common origin. On the other hand the pistils of *V. Clauseniana* and *V. McCabeiana* are of a different type (pl. 22) and thus in spite of the foregoing resemblances indicate a different origin.

In discussing affinities of this violet, one should perhaps consider two other species, *Viola cognata* and *V. nephrophylla* both named by E. L. Greene. Two British Columbia collections (Vaseaux Lake, McCabe 5874; south of Kinbasket Lake, McCabe

6263) are very similar to *V. cognata* and would pass for that species in this early stage were it not for a vestige of pubescence on one of the maturer leaf-blades. The fact that both species have purple-tinted leaves during the early spring growth adds to the difficulty in distinguishing them before leaf blade elongation has started. The pistils, however, differ widely (pl. 22) and thus make identification certain when flowers are available. *Viola nephrophylla* occupies a lower life zone, possesses a different rootstock, is entirely without pubescence of any kind as well as without purple tinting of leaves. However, the character of the pistil (pl. 22) shows a somewhat close relationship with *V. McCabeiana*.

Santa Rosa Junior College,
September 8, 1939.

DR. SETCHELL AND ALASKA WILLOWS

CARLETON R. BALL

A phycologist went willow-wise. In 1931, while the writer was with the University of California, Dr. William A. Setchell, then head of the Department of Botany and sixty-seven, planned a summer trip to Alaska with Mrs. Setchell. He decided to collect willows exclusively. What willows were known from Alaska? He looked at herbarium specimens—made mental photographs. What other willows might occur in Alaska? He looked at more herbarium specimens. Said of one (*Salix pseudo-monticola* Ball), "It looks like a service-berry" (*Amelanchier*). It does.

In the two summers of 1931 and 1932 Dr. and Mrs. Setchell brought back 619 numbers of willows from Alaska and the Yukon. These contained twenty-one species out of some twenty-four then known to occur in Alaska, as well as many of their varieties. That was remarkable in itself, when we remember that Dr. Setchell travelled only three major north-south routes and the Yukon River. Of the three species he did not get, *Salix ovalifolia* does not occur in the area he covered and *S. polaris* and *S. stolonifera* are rare and of local occurrence.

More remarkable still was the fact that he brought back abundant collections of five species not previously known from Alaska. These were *Salix anglorum* Chamisso, *S. Barrattiana* Hooker (represented by var. *angustifolia* And., *S. albertana* Rowlee), *S. lasiandra* Benthham (represented by var. *lancifolia* (And.) Bebb), *S. pseudo-monticola* Ball, and *S. Setchelliana* Ball. The latter, from the snout of the Muldrow Glacier, in Mount McKinley National Park, was new to science and has been found at only two other localities.

His collections added two other varieties not previously known from Alaska and provided material of what later were described as three new varieties, all previously collected by others. He

also greatly extended the known ranges of several species and varieties.

How did he do it? Four answers. 1. By giving attention only to willows. 2. By keen memory and observation. He brought in six Alaskan sets of the willow which "looked like a service-berry." Said he, "Whenever I saw a willow which looked like that, I just collected it." 3. By gathering all the different forms observed at each stop, instead of deciding that they were the same as those collected at previous stops. 4. By making friends with everyone along the route. The Alaska and Yukon railroad furnished a gasoline speeder and "chaffeur" so that he could stop at any willow patch he saw. The steamboat captains told him when they were to stop to load firewood for the boilers at out-of-the-way places and whistled him when ready to leave. They let him dry his specimens in the boiler rooms. Auto drivers halted for a quick grab from roadside willow thickets.

Still more surprises! Out in the Missouri Valley, *Salix missouriensis* is called the "diamond willow" because occasionally it produces diamond-shaped scars or depressions on the stems. These are caused by the atrophy of the lowermost trunk twigs in thickets and the failure of the wound to heal over. If all or most of the lower twigs die, the diamond pattern is that of the phylotaxy of the species. Such specimens are highly prized for the making of ornamental canes. The closely related *S. lutea* of the Rockies also produces such diamonds. No other species were known to exhibit this phenomenon. At Gulkana in Alaska, Dr. Setchell observed beautifully bicolored log banisters displaying diamond markings. On inquiry, he learned that they were willow poles brought by Indians from the swamps. At Gulkana Roadhouse he found that the Indians had brought in a small log, now in the University botanical museum, and the makings of a beautiful walking stick, now a highly cherished possession of the writer. The material was from *Salix alaxensis*, a tree willow not previously known to produce "diamonds."

Botanists, biologists, agronomists, foresters, geologists, and explorers have been collecting plants in Alaska and Yukon territories for more than forty years. Yet one man, in two summers, added five species and two varieties of a single genus to the known flora. Exceptional results because of an exceptional man? Yes, and that gives us something to think about. Should a democracy cherish quantity or quality? When quintuplets or quadruplets are born, everything which money and science can accomplish is done for them, without regard to their heredity or promise of achievement. Who is seeking to discover and subsidize the superior child singly born?

Extension Service, United States
Department of Agriculture, Washington, D. C.,
March 31, 1940.



PLATE 24. WILLIAM ALBERT SETCHELL, PROFESSOR OF BOTANY, EMERITUS, UNIVERSITY OF CALIFORNIA, BERKELEY. (Photographed by W. C. Matthews, 1937.)

A PLEISTOCENE RECORD OF PSEUDOTSUGA MACROCARPA

HERBERT L. MASON

Pseudotsuga macrocarpa (Torr.) Mayr. is an endemic species of the mountains of southwestern California which ranges from Mount San Pedro Martir in Lower California to the San Rafael Mountains of Santa Barbara County. It is commonly associated with *Pinus Coulteri*. In the vicinity of Figueroa Mountain, in Santa Barbara County, its range is contiguous to that of *Pinus Sabiniana*, which grows on the less protected slopes immediately below. A discontinuity in range of the width of San Luis Obispo County separates it geographically from the northern species, *Pseudotsuga taxifolia*. These two forest trees are closely related and are not readily separable in some of their morphological characters. They differ from one another primarily in the larger average size of the cone and in the greater rigidity of the cone scales of *P. macrocarpa*, as well as in certain little understood matters of tolerance that lie behind their difference in geographic range.

Both species, as well as certain presumably ancestral types, have been reported from the fossil record of western North America. *Pseudotsuga miocena* Penhallow (7, p. 70), *P. sonomensis* Dorf (3, p. 72) and *P. Masoni* MacGinitie (4, p. 47) have been interpreted as bearing a relationship to *P. taxifolia*. Fossils determined as the modern *P. taxifolia* (5, p. 151) have been reported from Pleistocene deposits. *P. praemacrocarpa* Axelrod (1, p. 167), as the name indicates, was interpreted by its author as ancestral to *P. macrocarpa*. Wood has been found in a locality on the Mad River in Humboldt County, California, and referred by Penhallow (6, p. 68) to *P. macrocarpa* with the remark that "it is identical with the species as it grows on the adjoining hill." It is, therefore, obvious that Penhallow was dealing with *P. taxifolia*, since *P. macrocarpa* does not occur that far north.

Since *Pseudotsuga praemacrocarpa* from the Pliocene Mount Eden beds of southern California is the only authentic fossil record of the *P. macrocarpa* type, it is of interest to note the discovery of a specimen from the Pleistocene asphalt deposits at Carpinteria, California. This specimen closes the gap in the record from the Pliocene to the present. The occurrence of the fossil in the Carpinteria asphalt is not far from the northern limit of the species today in the Zaca Lake area, San Rafael Mountains, Santa Barbara County. The proximity of the two localities, however, in no way indicates the great difference in the habitat of the modern tree and that recorded in the Carpinteria flora. As reported by Chaney and Mason (2), the Carpinteria asphalt contains a maritime flora dominated by *Pinus radiata*, *P. muricata* and *Cupressus Goveniana*, with a conspicuous understory flora of

Arctostaphylos, *Ceanothus* and live oaks. In addition to this forest assemblage, there were elements of two other floras—namely, the coastal redwood flora of the north and the arid interior digger pine-juniper association. The species of these associations were represented by very fragmentary material. The first of these fragmentary floras is represented by a water-worn piece of wood of the genus *Sequoia* which was washed up on what is now a fossil

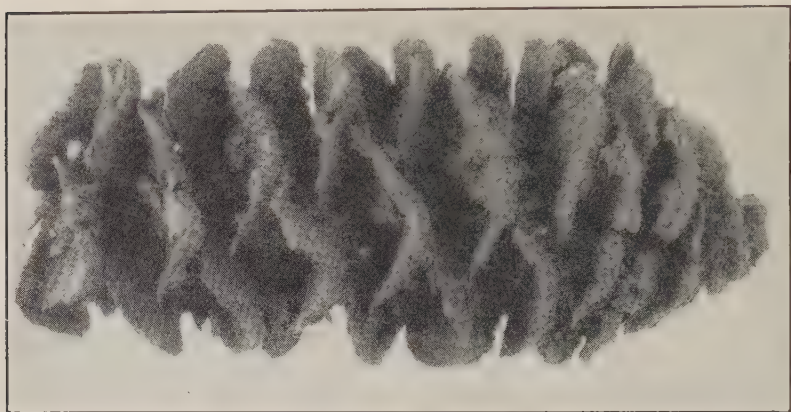


FIG. 1. Fossil cone of *Pseudotsuga macrocarpa*. Natural size.

beach. The absence of any other evidence of *Sequoia* and the nature of this occurrence led the writers to the conclusion that it did not grow in the immediate vicinity but was washed up by waves after a journey of considerable distance. The other of these floras is represented by a few fruits of *Juniperus californica* and *Arctostaphylos glauca* and a worn scale of a cone of *Pinus Sabiniana*. Both *Juniperus californica* and *Arctostaphylos glauca* are very prolific seed-producers and the scarcity of their seeds in the fossil record suggested that they could not have been produced close to the deposit but must have been borne by stream from some distance inland. The condition of the cone scale of *Pinus Sabiniana* and the absence of any further evidence of this species in so rich a fossil flora was accepted as evidence that it was not a member of the plant association in the immediate vicinity. It, too, must have been carried into the deposit by the stream in whose bed the fossils were laid down.

Pseudotsuga macrocarpa is another such element. It is not a coastal species but prefers the more arid interior mountains. It occurs in a zone at the upper limit of *Pinus Sabiniana* in close association with *Arctostaphylos glauca* and *Juniperus californica*. The fragmentary nature of the specimen attests its transport. Both ends of the cone are missing, the bracts are almost all broken off, and the scales all show marks of battering. In this deposit there are flowers with such delicate structures as stamens

preserved. It would seem that a woody cone, particularly if of local derivation, should be well preserved. Those cones of the other species in the deposit that are obviously from nearby are well preserved.

The cone was collected by Mr. David Rogers of the Santa Barbara Museum of Natural History and was sent to Dr. Chester Stock of the California Institute of Technology and later referred to the writer for identification. The specimen is now in the paleontological collections of the Museum of Natural History of Santa Barbara.

Department of Botany,
University of California, Berkeley,
February, 1940.

LITERATURE CITED

1. AXELROD, D. I. A Pliocene Flora from the Mount Eden Beds of California. Carnegie Inst. Wash. Publ. no. 476: 125-185. 1937.
2. CHANEY, R. W., and H. L. MASON. A Pleistocene Flora from the Asphalt Deposits at Carpinteria, California. Carnegie Inst. Wash. Publ. no. 415: 45-79. 1933.
3. DORF, E. Pliocene Floras of California. Carnegie Inst. Wash. Publ. no. 412: 1-112. 1933.
4. MACGINITIE, H. D. The Trout Creek Flora of Southeastern Oregon. Carnegie Inst. Wash. Publ. no. 416: 21-68. 1933.
5. MASON, H. L. Fossil Records of West American Conifers. Carnegie Inst. Wash. Publ. no. 346: 139-158. 1927.
6. PENHALLOW, D. P. Notes on Tertiary Plants. Trans. Roy. Soc. Canada, ser. 2, 8 (sec. 4): 33-95. 1903.
7. ———. Notes on Tertiary Plants from Canada and the United States. Trans. Roy. Soc. Canada, ser. 2, 10 (sec. 4): 57-76. 1904.

A NEW SPECIES OF LECIDEA FROM BRAZIL

ALBERT W. C. T. HERRE

Among the lichens collected by the late Ynes Mexia, indefatigable and enthusiastic botanical explorer, occurs a *Lecidea* which I am reluctantly compelled to describe as new. It is quite unlike anything described by Wainio in his classic study on the lichens of Minas Geraes, or any species mentioned by Zahlbruckner in his papers on Brazilian lichens.

Lecidea viçosensis sp. nov. Thallus effusus, tenuis, granulato-crustaceus, continuus ecorticatus, pallido fulvocinereo-testaceus, sorediis et isidiis destitutus, KOH—, CaCl₂O₂—. Apothecia biatorina, sessilia, primum planiuscula, parva, margine pallido et prominulo, dein magna difforma solitaria aut mox convexa aggregata-conglomerata, cervino-rufescente et nigricanti-fusco; hypothecium angustum umbrino-fuscum; hymenium I caeruleum; sporae octonae, in ascis biseriales, simplices, decolores, ovaes et ellipsoidae, 7.75-9.5 μ late et 15.5-20 μ longae.

Ad corticem arboris, Fazenda de Aguada, Viçosa, Minas Geraes, Brazil, Julio 31, 1930, legit Ynes Mexia 4295a.

The type is in the University of California Herbarium, no. 510550, and a paratype is in the author's herbarium.

The thallus forms a thin continuous granular crust without cortex, soredia, or isidia, and spreads out in an indeterminate way; its color is pale tawny to ashy yellow brown; no chemical reactions. The sessile biatorine apothecia are at first small, flat, with a prominent pale margin, then large, irregular and solitary, but afterward forming convex crowded clusters; their color varies from tawny reddish to blackish dark brown; the broad hypothecium is very dark brown; the hymenium turns blue with iodine; the simple colorless spores are eight in number, arranged in two rows in the asci, oval to ellipsoid, $7.75-9.5\ \mu$ broad and $15.5-20\ \mu$ long. The scanty specimens form a conspicuous crust on the bark of tree trunks, growing on a steep wooded slope at Fazenda de Aguada, near Viçosa, state of Minas Geraes, Brazil, at an altitude of 700 meters.

Natural History Museum,
Stanford University, California,
February 20, 1940.

ADDITIONS TO OUR KNOWLEDGE OF THE FLORA OF MOUNT BAKER, WASHINGTON. II.

W. C. MUENSCHER

Since the appearance of the first note under the above title¹ I have had an opportunity to do some more botanizing in Whatcom County, Washington. The following list includes twenty-four species, obtained in 1939, apparently not previously recorded from the Mount Baker region. Acknowledgement is due to Professor K. M. Wiegand for assistance in the determination of several species. The specimens are deposited in the herbarium of Cornell University.

GRAMINEAE

AGROSTIS SCABRA Willd. On dry stony slopes; Green Creek; Hildebrand Lake.
BROMUS CARINATUS Hook. and Arn. On moraines, from Baker Lake to Easton Glacier.

BROMUS SUKSDORFII Vasey. On rocky slope along Ruth Creek.

PANICUM PACIFICUM Hitchc. and Chase. On rocky shelves and ledges; common on the Twin Sister Range.

PLEUROPOGON REFRACTUM (Gray) Benth. In boggy meadows, Elbow Lake.

POA STENANTHA Trin. On ledges of alpine meadows on Skyline Ridge.

MELICA SMITHII (Porter) Vasey. In open woods between Glacier and Skyline Ridge.

CYPERACEAE

CAREX SCIRPOIDEA Michx. On gravelly moraines near the headwaters of the South Fork of Nooksack River.

CAREX MICROPTERA Mack. On alpine slopes, Mount Hermann.

SCIRPUS CAESPITOSUS L. Moist ledges and alpine bogs; Twin Sister Range.

¹ Muensch, W. C. Additions to our Knowledge of the Flora of Mount Baker, Washington. Madroño 4: 263-270. 1938.

JUNCACEAE

JUNCUS REGELLII Buch. On moist spring-fed slopes, west arm of Mount Shuksan and Panorama Dome.

ORCHIDACEAE

CALYPSO BOREALIS L. Mossy coniferous forest, Skyline Ridge.
HABENARIA UNALASKENSIS Spreng. Open forest along bank of Green Creek.

SALICACEAE

SALIX MELANOPSIS Nutt. In springy bogs near headwaters of South Fork of Nooksack River.

SAXIFRAGACEAE

SAXIFRAGA CAESPITOSA L. On exposed ledges above timber line on Twin Sister Range.

SAXIFRAGA SAXIMONTANA E. Nels. On rocky slopes in alpine meadows.

ROSACEAE

POTENTILLA EMARGINATA Pursh. In crevices of dry ledges above timber line, Skyline Ridge; Twin Sister Range.

ONAGRACEAE

EPILOBIUM GLAREOSUM G. N. Jones. On dry rocky slopes, Mount Hermann.

ERICACEAE

ALLOTROPA VIRGATA Torr. and Gray. In coniferous forests on dry ridges.

BORAGINACEAE

AMSINCKIA INTERMEDIA Fisch. and Meyer. On gravelly soil along roadside near Glacier.

COMPOSITAE

AGOSERIS AURANTIACA (Hook.) Greene. On moraines, above timber line.
ERIGERON AUREUS GREENE. Local in rock crevices on high alpine slopes.
MADIA DISSITIFLORA (Nutt.) Torr. and Gray. On dry banks near Glacier.
TARAXACUM CERATOPHORUM (Ledeb.) DC. On shale slope near perpetual ice, west slope of Mount Baker.

Cornell University, Ithaca, New York,
 January, 1940.

REVIEWS

A Manual of Aquatic Plants. By NORMAN C. FASSETT. Pp. 1-382. McGraw-Hill Book Company, New York. 1940. \$4.00.

This is a treatment of a special group of plants that fills a real need of persons engaged in wildlife study or game management as well as of the botanist who must meet public service problems requiring the quick identification of aquatics with only fragmentary material. The work covers the region "from Minnesota to Missouri and eastward to the Gulf of St. Lawrence and Virginia," a restriction of range that is not made clear in the title. However in view of the widespread occurrence of many aquatic plants the book will be found useful over a much wider area than is indicated by these limits. "Bogs, which are often saturated, are excluded from this work as are small woodland brooks, waterfalls, tidal, salt

and brackish waters. With the field thus circumscribed it is still very indefinite." The book is profusely illustrated with excellent line drawings aimed to simplify the problem of identification. The keys are dichotomous with the exception of the first which comprises seventeen simple statements each of an outstanding character that is intended to guide the user to another key to the group under investigation. The keys make full reference to illustrations of specific points which facilitate their use enormously and eliminate the necessity of many words of description. The appendix is directed mainly to the field of game management. It consists of an annotated list of plants with statements of their use by various categories of birds and by mammals and fish; there are bibliographic references to such uses. The author is to be congratulated on the completion of so useful a book.—H. L. MASON.

A Manual of the Liverworts of West Virginia. By NELLE AMMONS. American Midland Naturalist 23: 3-164, pls. 1-26. 1940. University Press, Notre Dame, Indiana. Cloth \$1.75.

This manual includes 56 genera and 111 species, 23 more than have been reported previously for West Virginia. The Jungermanniales comprise a large proportion of the hepatic flora, only 15 species being recorded for the Marchantiales. No new combinations or species are proposed. Dr. Ammons follows the system recently proposed by Evans (Bot. Rev. 5: 49-96. 1939), an arrangement of groups differing from that found in most current floras.

Many items not usually found in bryological manuals are included. In the preface are brief paragraphs on the topography of West Virginia, the history of the study of liverworts in the state, the collection and care of liverwort specimens and a general discussion of the life history and structure of Hepaticae followed by a table giving the differences between mosses and liverworts. These last two sections serve as an introduction to Hepaticae for those who have had no formal bryological training. Brief descriptions of the orders and suborders of Hepaticae followed by an outline giving the sequences of families and genera as proposed by Evans introduce the taxonomic treatment. The main key is to genera rather than to families. This is probably the reason that Dr. Ammons used the less graphic numerical type of key rather than a simple dichotomous key. In a few instances, characters in the key would be extremely difficult to use if one were not already familiar with the group. "Thallus with pores (some exceedingly small and barely discernible)" as opposed to "thallus without pores," is a character that might well stump the amateur. For each species is given a brief description which stresses vegetative rather than reproductive characters, habitat, distribution according to counties within the state and general

distribution throughout North America. In many cases additional notes are given that will help to distinguish the species from closely related entities. Twenty-six plates of detailed illustrations for all species included in the manual supplement the descriptions. The author is to be congratulated for making all drawings in a given series on the same scale. Four appendices cover species excluded, abbreviations and names of authors, meanings of specific names and a glossary. Although of interest, these appendices are not all essential. A useful bibliography of 193 titles completes the text. The manual gives evidence of much careful and painstaking work and is a welcome addition to the literature on Hepaticae. Since many of the species are widely distributed, the work will be of value to bryologists in other parts of North America.—ANNETTA CARTER, Department of Botany, University of California, Berkeley.

Desert Wild Flowers. By EDMUND C. JAEGER. Stanford University Press. Pp. 1-322, 764 figs. Stanford University Press, Stanford University, California. 1940. \$3.50.

Here is a book written for every nature lover who wishes to learn a good deal more about the plant life found on the Mohave and Colorado Deserts. Fewer and fewer people can resist the temptation to travel out into the arid wastes of the Southwest these days, and this volume is a fine introduction to the plant friends one will make there, whether he is going to Death Valley or the lower Colorado River. It is a scientifically accurate book written for the amateur and it is filled with interest for the widest audience.

Mr. Jaeger combines the varied training of a naturalist with the skill of a keen observer and the accuracy of a scientist. He has been a student of desert natural history for twenty-five years and himself first discovered in California several of the plants of which he tells. Furthermore, he knows how to present his story in a simple, colorful style. Consequently, this book not only describes the plants, but tells us a great deal about the animal life associated with them, as well as many details about habitats, economic uses, and life histories.

In addition to the latest scientific name, each plant has been given a common one chosen with meritorious care. Perhaps it is only the professional taxonomist who will regret the omission of the author of the scientific name. The concise descriptions are valuable aids to making the correct determinations, but they are intended only as supplements to the excellent line drawings that accompany each species. Mr. Jaeger himself was the artist and he travelled thousands of miles to sketch the plants in flower from life. The seven hundred and sixty-four line drawings and photographs serve as the only "key" to the book. One looks at the pictures, which follow the usual systematic sequence, until he matches his unknown plant. Then he verifies his determination by a peru-

sal of the careful descriptions. Since practically all the members of the flora of the California deserts have been included, this little handbook can properly lay claim to being the most complete work ever published on the flora of that region. Without doubt it is also the best. Its quality depends not only upon the careful work of its author, but upon the excellent handling given it by the publisher.—D. D. KECK.

NOTES AND NEWS

SOUTHERN OCCURRENCES OF *ALLIUM CRENULATUM* AND *MECONELLA OREGANA*. *Allium crenulatum* Wiegand seems to have been recorded previously only from the Olympic Mountains in northwestern Washington. However, collections of this species with its flattened and characteristically crenulate scapes, have been made in northwestern Oregon as follows: rocky, exposed slope, Saddle Mountain, Clatsop County, June 15, 1936, *John Ifft & S. G. Wildman* 58; turf on open upper slope, Saddle Mountain, June 24, 1938, *G. B. & R. P. Rossbach* 518; loose turf on dry ledge, shoulder of Humbug Mountain (very near Saddle Mountain), June 25, 1938, *G. B. & R. P. Rossbach* 445. These collections are in Dudley Herbarium, Stanford University.

Meconella oregana Nutt. seems not to have been recorded south of Oregon. The following collections, at least, have been made in California: Fish Ranch road, Berkeley Hills, Contra Costa County, 1935, *Adelyn Helsley* 163 (Herb. Univ. Calif., Berkeley); moist flat, Mount Hamilton, eight miles from summit on road to San Antonio Valley, Santa Clara County, April 6, 1930, *J. T. Howell* 4662 (Herb., Calif. Acad. Sci.); moist soil, base of hillside along Arroyo Bayo, Dr. H. J. Beaver ranch, east side of Mount Hamilton, Santa Clara County, April 24, 1938, *G. B. & R. P. Rossbach & H. J. Beaver* 665 (Dudley Herb.).—GEORGE B. AND RUTH P. ROSSBACH, Stanford University.

Mr. Norman Nevills will lead an expedition of nine on a trip down the Green and Colorado rivers, leaving Green River, Wyoming, June 20, 1940, and arriving at Boulder Dam about August 25. The group will travel in three specially designed boats and will make botanical and geological observations and collections in the little known Canyon country. Dr. Hugh C. Cutler, of Washington University, is in charge of botanical research and Mr. Nevills of the geological work.

Mr. John Thomas Howell of the California Academy of Sciences, one of the readers of my article in the April, 1940, issue of *MADROÑO*, suspected that the species referred to therein as *Carduus pycnocephalus* was not that species but one closely allied to it. An exchange of material has permitted both of us to become satisfied that our introduced species is *C. tenuiflorus* Curt. I wish to express my sincere appreciation of the courtesy shown me by Mr. Howell in making possible the early correction of this error.—V. L. CORY.